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AUTHOR Crawford, Glenda
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ABSTRACT

The fourth in a series of six guidebooks on minimum course content for second-year algebra, this booklet covers linear and quadratic relations, absolute value, graphing complex numbers, determinants and matrices, graphing quadratic relations, and solving systems of linear and quadratic equations. Overall course goals are specified, a course outline is provided, performance objectives are listed, and text references keyed to the performance objectives are provided. A sample posttest is included along with a 13-item bibliography. (JP)

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ED 093704

AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

MATHEMATICS: Algebra 2S 5216.24

SE018 078

DADE COUNTY PUBLIC SCHOOLS
DIVISION OF INSTRUCTION • 1973

ED 093704

QUINMESTER MATHEMATICS

COURSE OF STUDY
FOR

ALGEBRA 2
5216.24

(EXPERIMENTAL)

Written by

Glenda Crawford

for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida 33132
1971-72

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Miami, Florida 33132

PREFACE

The following course of study has been designed to set a minimum standard for student performance after exposure to the material described and to specify sources which can be the basis for the planning of daily activities by the teacher. There has been no attempt to prescribe teaching strategies; those strategies listed are merely suggestions which have proved successful at some time for some class.

The course sequence is suggested as a guide; an individual teacher should feel free to rearrange the sequence whenever other alternatives seem more desirable. Since the course content represents a minimum, a teacher should feel free to add to the content specified.

Any comments and/or suggestions which will help to improve the existing curriculum will be appreciated. Please direct your remarks to the Consultant for Mathematics.

All courses of study have been edited by a subcommittee of the Mathematics Advisory Committee.

CATALOGUE DESCRIPTION

Further work with linear and quadratic relations. Includes absolute value and graphing of complex numbers, determinants and matrices, graphing quadratic relations, and solving systems of linear and quadratic systems.

Designed for the student who has mastered the skills and concepts of Algebra 2p.

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OVERALL GOALS

The student will:

1. Achieve competence in the basic arithmetic skills, gain understandings requisite for solving computational problems, and use the properties of mathematical structure.

2. Develop reading skills used in mathematics.

3. Develop the ability to define, categorize, analyze, evaluate, interpret, and communicate through symbolic mathematical expressions in problem-solving situations.

4. Appreciate the significant role of mathematics in the development of civilization in the past, present, and future, and become more aware of the ever increasing dependence that man has upon mathematics for his future development.

5. Develop both inductive and deductive reasoning in a mathematical context, with emphasis placed on their application to mathematical proofs and life situations.

   Note: The above overall goals are from Florida Standards 1971-72.

6. Develop those comprehensions and skills in the language of mathematics which will allow for further study in mathematics and science.

TEXT BIBLIOGRAPHY
(*State-adopted)

D_3 - Dolciani, Mary P.; Berman, Simon L.; and Wooten, William. Modern Algebra and Trigonometry, Book 2. Boston: Houghton Mifflin Company, 1963.

*D_8 - Dolciani, Mary; Wooten, William; Beckenback, Edwin; Sharron, Sidney. Modern School Mathematics, Algebra II and Trigonometry. Boston: Houghton Mifflin Company, 1968.

N - Nichols, Eugene D.; Heimer, Ralph T.; Garland, Henry C. Modern Intermediate Algebra. New York: Holt, Rinehart and Winston, Inc., 1965.

*PL - Payne, Joseph N.; Zamboni, Floyd F.; and Lankford, Francis G., Jr. Algebra Two with Trigonometry. New York: Harcourt, Brace and World, Inc., 1969.

*PA - Pearson, Helen R. and Allen, Frank B. Modern Algebra, A Logical Approach, Book Two. Boston: Ginn and Company, 19cc.

COURSE OUTLINE

Related Objectives	
	I. Complex numbers
1,2	A. Graphing
	B. Absolute value
3	II. Solution of systems of linear equations in two variables
	A. Substitution
	B. Addition
	C. Matrix
	D. Determinant
4,5	III. Quadratic relations
	A. Identify and graph
	1. Circle
	2. Ellipse
	3. Parabola
	4. Hyperbola
	B. Determine the equation from a graph
	1. Circle
	2. Ellipse
	3. Parabola
	4. Hyperbola

Course Outline (continued)

Related Objectives	
6,7	IV. Quadratic inequalities
	A. In one variable
	1. Solve
	2. Graph
	B. In two variables
	1. Graph
8,9	V. Systems of equations involving quadratics
	A. Solve by graphing
	B. Solve algebraically
10	VI. Word Problems

REFERENCES

OBJECTIVE	PL	PA	D_8	D_3	N
1	172	610 615	585	398	251
2	43 176	610	585	450	273
3	299	241 652 240	205	97	298
	294	648	204	97	300
	327	---	654	558	---
	341	655 657	---	566	307
4	418 421 425 427	--- 688 337 691	442 449 445 453	300 306 227 309	322 322 322 322
5	444 437	---	---	---	---
	444 437	---	---	---	---
	444 437	---	---	---	---
	444 437	---	---	---	---
6	276	374	363	297	240
7	277 442	374	447 448 452 458	236 302 306 309 316 319	326

References (continued)

OBJECTIVES	PL	PA	D_8	D_3	N
8	438	698 703	464	319	322
9	438	699 703	465 468	321 324	314 321
10	302 306 308 310 433	658 702	213 453 467 470	102 306 316 322 325	302 317 323

PERFORMANCE OBJECTIVES

The student will:

1. Graph complex numbers.

   Assume students know how to graph (x,y) on coordinate axis. Teach graphing of a + bi - Explain ordered pair (a,b) can represent a + bi. Practice graphing points.

2. Define absolute value of complex numbers.
   Assume students can define the absolute value of real numbers. Define the absolute value of complex numbers. Show this is consistent with definition of the absolute value of reals.

3. Solve a system of linear equations in two variables by:
   a. substitution
   b. elimination by addition-subtraction
   c. matrices
   d. determinants

      (a) substitution method of solving a system of linear equations
      (b) addition method of solving a system of linear equations--stress equivalent systems and family of lines
      (c) define a matrix--stress the three operations to use when solving a system of linear equations by matrices. These operations are:
         (1) multiplication of all elements of a row by the same number.
         (2) addition of the same multiple of the elements of one row to corresponding elements of another row.
         (3) interchange rows. Note: Can easily be extended to a system of 3 and 4 linear equations.
      (d) have students solve for x and y.

$$a_1x + b_1y = c_1$$

$$a_2x + b_2y = c_2$$

4. Identify and graph quadratic relations including the circle, ellipse, parabola, and hyperbola.
   Practice graphing a:
      (a) circle
      (b) ellipse
      (c) parabola
      (d) hyperbola
   when the equation is in standard form.

Performance Objectives (continued)

5. Determine the equation of the relation given the graph of a circle, ellipse, parabola and hyperbola.
Sketch a circle, ellipse, parabola and hyperbola on the board and have students give the equation in standard form. After examples of this type, move from the general case to specific cases.
   (a) circle
   (b) ellipse
   (c) parabola
   (d) hyperbola

6. Solve quadratic inequalities in one variable and graph the solution set.
In explaining the method for solving quadratic inequalities in one variable and the graph of the solution set, Payne has the best example and stresses union and intersection.

7. Graph a quadratic inequality in two variables.
Graph examples letting students guess what area to shade. Show how to check the guess in order to determine where shading should occur.

8. Solve a system of equations involving quadratics graphically (linear and quadratic as well as quadratics).
In solving quadratics graphically, it is best to choose problems which have small integral roots.

9. Solve a system of equations algebraically involving quadratics (linear and quadratic), (2 quadratics).
Sketch possibilities of line and curve for possible number of points of intersection. Sketch possibility of curve and curve for number of points of intersection.
In working examples, be sure to choose one that gives an answer which does not satisfy the original equation.

10. Write and solve mathematical models for word problems which can be solved by the algebraic skills developed in this quin.
Require many examples for all sections.

SAMPLE POSTTEST ITEMS

1. Graph each of the following on the complex plane.

   a. (2,3)

   b. -6

   c. 4i

   d. 4 + 6i

   e. 0

2. Find the absolute value of (-5 + 12i).

3. a. Solve by substitution

$$\begin{cases} 5x + y = 7 \\ 3x + 2y = 0 \end{cases}$$

   b. Solve by addition

$$\begin{cases} x - 4y = 2 \\ 2x - 5y = 1 \end{cases}$$

   c. Solve by matrices

$$\begin{cases} x + y = 6 \\ 2x - y = 3 \end{cases}$$

   d. Solve by using the ratio of determinants

$$\begin{cases} 2x + y = 6 \\ x - y = 4 \end{cases}$$

4. Graph the following equations

   a. $x^2 + y^2 = 25$

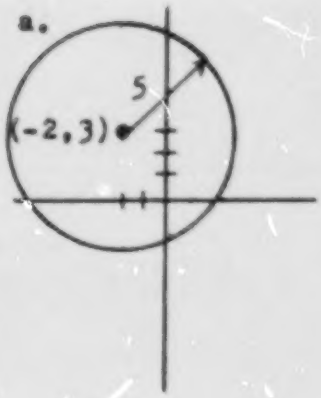
   b. $x^2 + 4y^2 = 36$

   c. $y = (x - 2)^2 + 3$

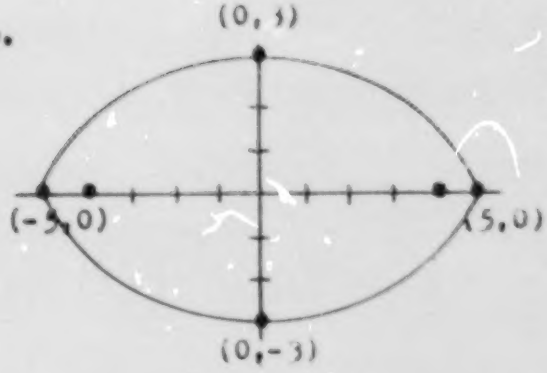
   d. $\frac{y^2}{16} - \frac{x^2}{9} = 1$

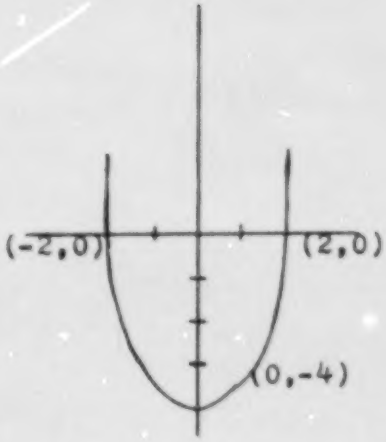
5. Write the equations of the following relations.

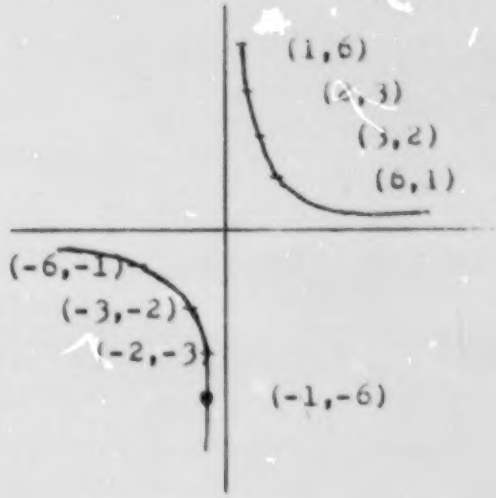
a.



b.







6. Find the solution set and graph the solution on a number line.

$$x^2 - x - 6 > 0$$

7. Graph:

$$\{(x,y) \mid y \leq (x-a)^2 + 3\}$$

8. Find the solution set graphically.

a. $\begin{cases} x^2 + y^2 = 4 \\ x = -2 \end{cases}$

b. $\begin{cases} x^2 + y^2 = 25 \\ y = -x^2 - 5 \end{cases}$

9. Find the solution set algebraically.

a. $\begin{cases} x^2 + y^2 = 13 \\ 2x - y = 4 \end{cases}$

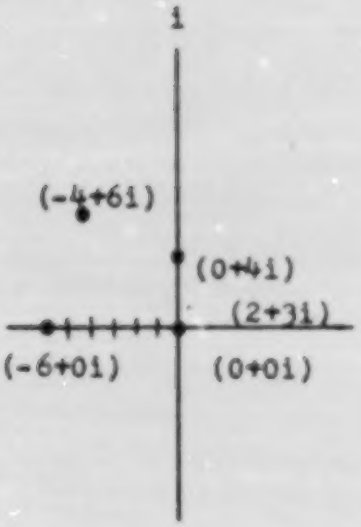
b. $\begin{cases} x^2 + y^2 = 25 \\ x + y^2 = 5 \end{cases}$

10. a. The square of the first number is equal to the second number. The sum of the two numbers is 2. Find the number.

b. The difference of the squares of two positive numbers is 33. The sum of their squares is 65. Find the number.

ANSWERS TO POSTTEST

1.



2.

$$\frac{|-5 + 12|}{\sqrt{(-5)^2 + (12)^2}}$$

$$\sqrt{25 + 144}$$

$$\sqrt{169}$$

$$13$$

3. a.

$$5x + y = 7$$
$$3x + 2y = 0$$

$$y = 7 - 5x$$

$$3x + 2(7 - 5x) = 0$$

$$3x + 14 - 10x = 0$$

$$-7x = -14$$

$$x = 2$$

$$5(2) + y = 7$$

$$y = 7 - 10$$

$$y = -3$$

$$5(2) + (-3) = 7$$

$$10 - 3 = 7$$

$$3(2) + 2(-3) = 0$$

$$6 - 6 = 0$$

b.

$$x - 4y = 2$$
$$2x - 5y = 1$$

$$2x - 8y = 4$$
$$-2x + 5y = 1$$

$$-3y = 5$$

$$y = -1$$

$$x - 4(-1) = 2$$

$$x + 4 = 2$$

$$x = -2$$

$$-2 - 4(-1) = 2$$

$$-2 + 4 = 2$$

$$2(-2) - 5(-1) = 1$$

$$-4 + 5 = 1$$

3. c. $\begin{matrix} x + y = 6 \\ 2x - y = 3 \end{matrix}$

$R_1 \cdot 2 + R_2 \quad \begin{pmatrix} 1 & 1 & 6 \\ 2 & -1 & 3 \end{pmatrix}$

$R_2 \cdot -\frac{1}{3} \quad \begin{pmatrix} -2 & -2 & -12 \\ 0 & -3 & -9 \end{pmatrix}$

$R_2 \cdot 2 + R_1 \quad \begin{pmatrix} -2 & -2 & -12 \\ 0 & 1 & 3 \end{pmatrix}$

$R_1 \cdot -\frac{1}{2} \quad \begin{pmatrix} -2 & 0 & -6 \\ 0 & 1 & 3 \end{pmatrix}$

$\begin{pmatrix} 1 & 0 & 3 \\ 0 & 1 & 3 \end{pmatrix}$

$x = 3$

$y = 3$

d. $\begin{matrix} 2x + y = 6 \\ x - y = 4 \end{matrix}$

$$X = \frac{\begin{vmatrix} 6 & 1 \\ 4 & -1 \end{vmatrix}}{\begin{vmatrix} 2 & 1 \\ 1 & -1 \end{vmatrix}}$$

$$X = \frac{-6 - 4}{-2 - 1}$$

$$X = 3\frac{1}{3}$$

$$Y = \frac{\begin{vmatrix} 2 & 6 \\ 1 & 4 \end{vmatrix}}{-3}$$

$$Y = \frac{8 - 6}{-3}$$

$$Y = \frac{2}{-3}$$

$$2\frac{(10)}{3} - \frac{(-2)}{3} = 6$$

$$\frac{20}{3} - \frac{2}{3} = 6$$

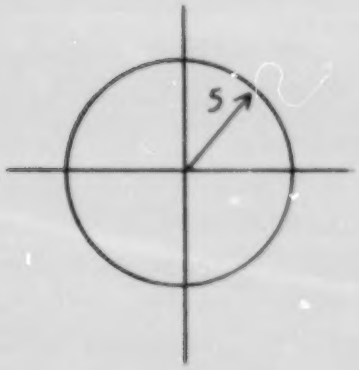
$$\frac{18}{3} = 6$$

$$\frac{10}{3} - \frac{(-2)}{3} = 4$$

$$\frac{10}{3} + \frac{2}{3} = 4$$

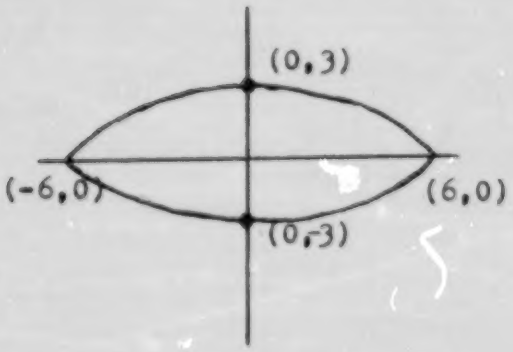
$$\frac{12}{3} = 4$$

4. a. $x^2 + y^2 = 25$

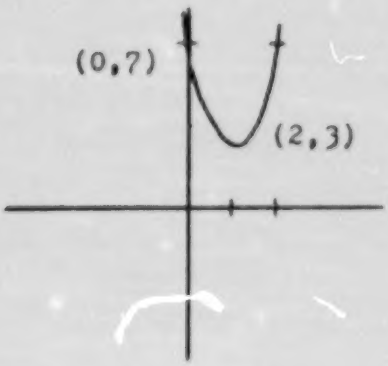


b. $x^2 + 4y^2 = 36$

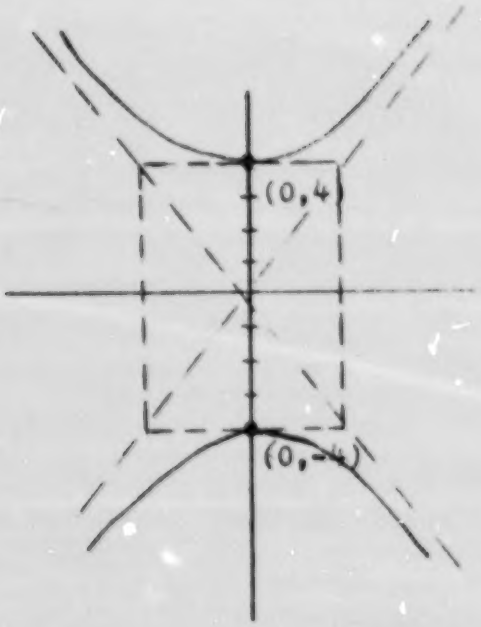
$\frac{x^2}{36} + \frac{y^2}{9} = 1$



c. $y = (x-2)^2 + 3$



d. $\frac{y^2}{16} - \frac{x^2}{9} = 1$



5. a. $(x + 2)^2 + (y - 3)^2 = 25$

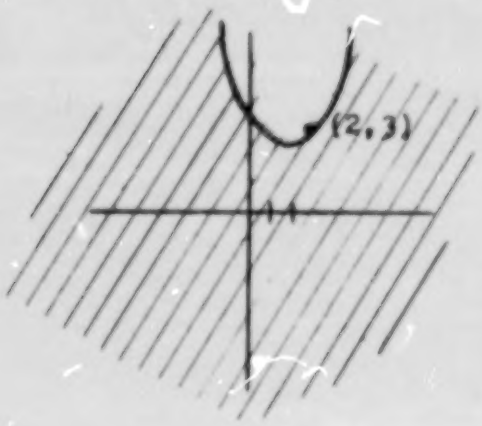
b. $\frac{x^2}{25} + \frac{y^2}{9} = 1$

c. $y = x^2 - 4$

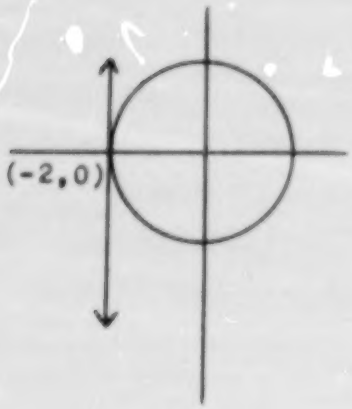
d. $xy = 6$

6.

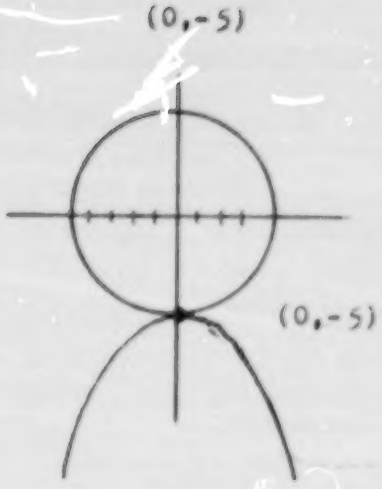
7.



8. a. $\{(-2,0)\}$



b.



9. a. $\left\{(3,2)\ \left(\frac{1}{5}, -3\frac{3}{5}\right)\right\}$

b. $\{(5,0)\ (-4,3)\ (-4,-3)\}$

10. a. -2 and 4

1 and 1

b. 7 and 4

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